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A PARASITIC OR COMMENSAL OLIGOCHÆTE IN NEW ENGLAND.

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Chaetogaster limnæi von Baer appears to be the only oligochæte which is generally recognized as a parasite ; at least it is the only one to which Michaelsen in his recent work on the subclass (*Das Tierreich, Oligochæta*, 1900) ascribes such habits. The species has been reported only from Europe, and it is therefore with pleasure that I am able to announce the discovery in the neighborhood of Boston of a very similar form, regarding which I can at present give only the following incomplete notes.

The worms were first found about the end of May, 1901, infesting a species of Physa, probably *P. heterostrophæ*, which was obtained in a small stream in Wellesley. They were also afterward observed upon an undetermined species of Planorbis. They were abundant about the head and in the respiratory cavity. In a few instances the hinder part of the body seemed to be imbedded in the tissues of the snail, but of this I cannot be sure. Most of them certainly were entirely free, and, waving about like tiny white threads, had much the appearance of a fungus. Occasionally I have noticed them, like the European form, crawling over the outside of the shell ; but they ordinarily restrict themselves to the body of the snail.

This is undoubtedly the animal mentioned by Gould (*Report on the Invertebrate Animals of Massachusetts*, 1841, p. 213) under the name of *Gordius inquilinus* Müller, and supposed by him to be a parasite of *P. heterostrophæ*. In none of the specimens taken under ordinary conditions, however, did the alimentary tract give any indications of a parasitic habit ; on the contrary, I have seen in it no other food than diatoms. It will be remembered that Lankester in his description of the European form ("A Contribution to the Knowledge of the Lower Annelids," *Trans. Linn. Soc.*, Lond., Vol. XXVI,

pp. 631-646, 1870) speaks of finding the worms in winter within *Limnæa*, and gorged with the kidney cells, while he seems to have found no such evidence of parasitism at other seasons. I should add that in one instance, in which the worms had been left for some time in a watch glass with a torn *Physa*, the alimentary canal of almost every one was found stuffed with the blackish pigment characteristic of the snail, which was floating in the water.

The worm is a small, transparent animal, about 2 mm. in length and 1-5 mm. in breadth at its widest point. Both these measurements are taken in extension, but as the creature reproduces by fission, and as colonies of at least three persons are common, the first impression is of a much longer organism than I have described. On the ventral side, near the anterior end, are two clusters of cephalic setæ; each seta is sigmoid, about 1-14 mm. long, and ends in a fork whose prongs are equal and are bent nearly at right angles to the shaft; each cluster ordinarily contains seven setæ, though there may be six or, very rarely, five. In one case, one side bore the full number of seven, while there were but two on the other. It would seem probable that the remaining ones had been torn away. At some little distance behind these clusters are the abdominal ones, which differ from the former only in that the setæ are smaller (about 1-23 mm. in length), more numerous (being, as a rule, eleven, rarely ten, in a cluster), and borne on a slight projection of the body which apparently corresponds to a rudimentary parapodium. This last peculiarity, combined with a habit of holding the hind end fixed while extending and waving about the anterior one, gives the worm, as Lankester has already remarked, a curious likeness to a geometrid larva. There are sometimes as many as thirteen pairs of seta clusters behind the cephalic one; it is difficult to determine how many of these should be reckoned as belonging to a single individual, but for reasons which will be given in discussing the budding, I am inclined to consider with Lankester that the adult has four pairs of abdominal clusters.

The large mouth lies at the anterior end, but the dorsal edge projects rather over the ventral one, so that the tip of the body

in side view appears obliquely truncate. The mouth leads directly into the pharynx, which occupies rather more than one-third the length of the animal, is extremely distensible, and is connected by muscle bundles to the body wall. The pharynx is succeeded by an œsophagus so short and narrow as to be, when the other parts are greatly dilated, quite indistinguishable. Next comes the stomach, which as seen in optical section is nearly square and is separated by a constriction from the intestine. This division is somewhat longer than broad, and its walls are usually characterized by a yellowish brown hue, sometimes to be observed also on the stomach and suggesting the chloragogue cells of *Lumbricus*. Opposite the third abdominal setæ is a constriction, at which point this yellow color suddenly disappears. The remaining part of the intestine varies in shape according to the degree of development of the buds. The hind end of the worm is slightly notched.

The stomach is often found filled with diatoms, with which are likely to be intermingled a few pebbles. The other parts of the alimentary tract, if not entirely empty, are usually nearly so.

There are five septa: one opposite the anterior and one opposite the posterior end of the œsophagus; one at the constriction between stomach and intestine, one opposite the middle of the intestine, and one at the point of its posterior constriction. Behind the fourth abdominal setæ is a zone in which the cœlom may be absent, and behind this region may appear the cœlom of the bud.

The large blood trunks are a dorsal pulsatile and a ventral non-pulsatile one. They are connected by a pair of pulsatile vessels which encircle the œsophagus. Lankester has figured a pair of anterior ones extending obliquely down and back around the pharynx; I have seen such vessels, but am not sure of the way in which they connect (as they undoubtedly do) with the longitudinal ones. The blood is colorless.

Of segmental organs I have observed only three pairs; they appear as coiled granular organs in the last three segments. I have not found them in the segment which corresponds to the anterior abdominal setæ.

The nerve cord is a fibrous-looking band encircling the œsophagus and running back along the ventral wall. In the region underlying the pharynx the ventral cords, although close together and connected by several cross branches, are perfectly distinct ; this portion sometimes shows clearly in living specimens, and I have remarked in it no ganglionic swellings. In a stained and mounted specimen, however, when seen in profile, two ganglia are clear and there are traces of a third.

Upon the reproductive system I have made no observations. The worms at the season at which I examined them appeared to have these organs undeveloped.

Every animal examined was in process of active budding. A comparison of different stages indicates that this process takes place in the following way. The first part to be formed is what I may call the abdominal portion ; that part, namely, which bears the abdominal seta clusters and which consists in the adult of four segments. These segments arise by terminal budding from the parent ; when two of them have been formed so that there is a series of six in all, there arises between the third and fourth a zone in the anterior part of which is differentiated a terminal segment, the fourth segment of the parent, while its posterior part is converted into the anterior part of the bud. During this process of differentiation another segment has arisen at the terminal end of the chain, so that when its anterior end is complete, the bud has four abdominal segments. Before it breaks away from the parent, however, a new individual has begun to develop between the two.

The series upon which these conclusions are based consists of the following stages : *a*, a terminal bud just ready to break away, and possessing four abdominal segments ; *b*, an older individual with five abdominal segments, the fifth one the youngest, as shown by its size and by the number and development of its setæ ; *c*, one with six abdominal segments present, but a zone as yet undifferentiated into segments between segments 3 and 4 ; *d*, a similar specimen, except that a seventh segment has been added at the hind end of the chain ; *e*, a specimen like *d*, except that two pairs of seta clusters are developing in the hitherto undifferentiated space between segments

3 and 4 ; *f*, one like *e*, but with a deep groove formed between the two sets of developing setæ.

Before the bud breaks away from the parent, a new individual has begun to develop between the two. In my experience, which has extended over only a single month, it has been rare to find a chain consisting of more than three persons, and as in such chains the older bud is often so far developed as to be readily detached from the rest by the pressure of the cover, I am inclined to doubt whether colonies of as many as sixteen zoöids (*cf.* Claus, *Würzburger naturwissenschaftliche Zeitschrift*, Bd. I, pp. 37-40, 1860) are ever found in our form.

Upon comparing this description with that given by Lankester for the European form, it will be seen that the only important difference which has been shown to exist relates to the number and arrangement of the setæ in the different bundles. I am uncertain how much importance should be attached to this difference. Lankester describes his species as having twelve setæ in the cephalic bundles and eight in the abdominal ones, and after having for more than three years "taken every opportunity of examining the little worms" states that this number is "almost invariable" (*Quart. Journ. Micr. Sci.*, n.s., Vol. IX, pp. 272, 276). Vejdovsky, on the other hand (*System und Morphol. d. Oligochaeten*, p. 36), in describing the same species, says : "Bezüglich der Anzahl der Borsten variieren die Bündel bedeutend, indem man auf den hinteren Segmenten gewöhnlich eine grössere Menge derselben vorfindet als in den vorderen Borstenbündeln. Im allgemeinen trifft man in einzelnen Bündeln, 8, 9, 10, 10-12 Borsten." I have not, however, in an incomplete but somewhat careful review of the literature, been able to find published authority for this statement of Vejdovsky.

In view of this uncertainty and of the fact that Lankester's paper, which contains the only full anatomical description of the European species, is somewhat difficult of access, it has seemed worth while to give a fairly full account of our own form. Lankester's plates are so complete and so admirable that it has not seemed desirable to add illustrations to this description.